

IN THE CLAIMS:

82. (New) A method of electric arc welding the joint between two plates, said method comprising:

(a) moving at least first and second consumable electrodes substantially in unison along said joint;

(b) at least periodically passing a first pulsating welding current between said first electrode and said plates with a first low frequency;

(c) at least periodically passing a second pulsating welding current between said second electrode and said plates with a second low frequency; and,

(d) at least partially controlling at least one of said low frequencies such that said first low frequency deviates from said second low frequency at least once as said at least first and second consumable electrodes are moved along said joint.

83. (New) The method as defined in claim 82, wherein at least one of said low frequencies is at least partially varied as a function of time.

84. (New) The method as defined in claim 83, wherein both of said low frequencies are at least partially varied as a function of time.

85. (New) The method as defined in claim 82, wherein at least one of said pulsating currents is an AC current.

86. (New) The method as defined in claim 83, wherein at least one of said pulsating currents is an AC current.

87. (New) The method as defined in claim 84, wherein at least one of said pulsating

currents is an AC current.

88. (New) The method as defined in claim 82, wherein at least one of said pulsating currents is a DC current.

89. (New) The method as defined in claim 83, wherein at least one of said pulsating currents is a DC current.

90. (New) The method as defined in claim 84, wherein at least one of said pulsating currents is a DC current.

91. (New) The method as defined in claim 82, wherein at least one of said welding currents is created by a high frequency switch inverter driven by a three phase line voltage.

92. (New) The method as defined in claim 83, wherein at least one of said welding currents is created by a high frequency switch inverter driven by a three phase line voltage.

93. (New) The method as defined in claim 91, wherein said high frequency is at least about 20 kHz.

94. (New) The method as defined in claim 91, wherein said first and second welding currents are independently created from the same three phase power supply.

95. (New) The method as defined in claim 92, wherein said first and second welding currents are independently created from the same three phase power supply.

96. (New) The method as defined in claim 91, wherein at least one power supply that supplies at least one of said welding currents including an inverter for converting AC voltage to a DC current source having a maximum current of at least 200 amperes.

97. (New) The method as defined in claim 95, wherein at least one power supply that supplies at least one of said welding currents including an inverter for converting AC voltage to a DC current source having a maximum current of at least 200 amperes.

98. (New) The method as defined in claim 96, wherein said AC voltage is three phase line voltage with a frequency of up to about Hz.

99. (New) The method as defined in claim 82, wherein at least one of said welding currents at least partially generated by at least one power supply having an output switching network at least partially operated at a given low frequency for directing a pulsating welding current at said given low frequency.

100. (New) The method as defined in claim 83, wherein at least one of said welding currents at least partially generated by at least one power supply having an output switching network at least partially operated at a given low frequency for directing a pulsating welding current at said given low frequency.

101. (New) The method as defined in claim 82, wherein at least one power supply that supplies at least one of said welding currents having a circuit for at least partially independently adjusting said given low frequency so the value of said first low frequency is at least partially different from said second low frequency.

102. (New) The method as defined in claim 99, wherein at least one power supply that supplies at least one of said welding currents having a circuit for at least partially independently adjusting said given low frequency so the value of said first low frequency is at least partially different from said second low frequency.

103. (New) The method as defined in claim 100, wherein at least one power supply that supplies at least one of said welding currents having a circuit for at least partially independently adjusting said given low frequency so the value of said first low frequency is at least partially different from said second low frequency.

104. (New) The method as defined in claim 82, wherein at least one of said frequencies is less than about 300 Hz.

105. (New) The method as defined in claim 103, wherein at least one of said frequencies is less than about 300 Hz.

106. (New) The method as defined in claim 82, wherein said consumable electrodes are advance welding wires.

107. (New) The method as defined in claim 82, wherein said first and second low frequencies are at least partially generated by the same power source.

108. (New) The method as defined in claim 83, wherein said first and second low frequencies are at least partially generated by the same power source.

109. (New) The method as defined in claim 82, wherein at least one power supply that

supplies at least one of said welding currents having a pulse width modulator for controlling the voltage between said terminals as a function of time to adjust the welding current.

110. (New) The method as defined in claim 83, wherein at least one power supply that supplies at least one of said welding currents having a pulse width modulator for controlling the voltage between said terminals as a function of time to adjust the welding current.

111. (New) The method as defined in claim 82, including a master controller for creating a synchronizing signal directed to at least one power supply and having a succession of synchronizing commands and means for forcing said at least one power supply to start its low frequency current upon receipt of a synchronizing command.

112. (New) The method as defined in claim 111, including a delay circuit for delaying the receipt of said synchronizing command for said at one of power supply for a selected time to phase shift said first and second welding currents.

113. (New) The method as defined in claim 111, including means for creating at least one of said low frequencies upon receipt of said synchronizing command.

114. (New) The method as defined in claim 82, including at least one said power supply that supplies at least one of said welding currents having an output switching network for directing a welding current from said terminals across one of said electrodes and said plates, and a circuit for independently adjusting said output switching network so the value of said first welding current is at least partially different from said second welding current, said output switching network including a first switch to create positive current across one of said electrodes and said plate and a second switch to create a negative current across one of said electrodes and said plate and a circuit to operate

said first and second switches to control said welding current.

115. (New) The method as defined in claim 114, wherein said circuit includes a switch selector to maintain one of said switches closed and the other of said switches opened.

116. (New) The method as defined in claim 114, wherein said circuit includes a switch selector to open and close said switches at a rate to create an AC welding current housing a selected frequency of up to about 300 Hz.

117. (New) A method of electric arc welding the joint between two plates, said method comprising:

(a) moving at least first and second consumable electrodes substantially in unison along said joint;

5 (b) at least periodically passing a welding current having a first waveform between said first electrode and said plates;

(c) at least periodically passing a second pulsating welding current have a second waveform between said second electrode and said plates; and,

10 (d) at least partially synchronizing said first and second waveforms to cause said welding currents to pass through said electrodes at least partially at the same time.

118. (New) The method as defined in claim 117, wherein each of said waveforms has its own power source.

119. (New) The method as defined in claim 117, wherein at least one of said waveforms is created by a number of current pulses occurring at a frequency of at least 18 kHz with a magnitude of each pulse controlled by a wave shaper.

120. (New) The method as defined in claim 117, wherein one of said waveforms is created by a different number of current pulses from said other waveform.

121. (New) The method as defined in claim 117, wherein said first and second waveforms are at least partially out of phase from one another.

122. (New) The method as defined in claim 117, wherein said first and second waveform are substantially the same.

123. (New) The method as defined in claim 117, including the step of at least partially controlling a polarity of at least one of the waveforms.

124. (New) The method as defined in claim 123, wherein said waveforms at least partially have the same polarity when said welding currents pass through said electrodes at the same time.

125. (New) A method of electric arc welding the joint between two plates, said method comprising:

(a) moving at least first and second consumable electrodes substantially in unison along said joint;

5 (b) at least periodically passing a welding current having a first waveform between said first electrode and said plates;

(c) at least periodically passing a second pulsating welding current having a second waveform between said second electrode and said plates;

(d) at least partially controlling a polarity of both waveforms; and,

10 (e) partially offsetting said first waveform from said second waveform by a controlled length of time, said waveforms at least partially having the same polarity when said welding currents

pass through said electrodes at the same time.

126. (New) The method as defined in claim 125, wherein each of said waveforms has its own power source.

127. (New) The method as defined in claim 125, wherein at least one of said waveforms is created by a number of current pulses occurring at a frequency of at least 18 kHz with a magnitude of each pulse controlled by a wave shaper.

128. (New) The method as defined in claim 125, wherein said first and second waveforms are at least partially synchronized.

129. (New) The method as defined in claim 125, wherein said first and second waveform are substantially the same.

130. (New) A method of electric arc welding the joint between two plates, said method comprising:

(a) moving at least first and second consumable electrodes substantially in unison along said joint;

5 (b) at least periodically passing a welding current having a first waveform between said first electrode and said plates;

(c) at least periodically passing a second pulsating welding current have a second waveform between said second electrode and said plates;

10 (d) at least partially controlling a polarity of the waveforms, said first and second waveforms each having a cycle length having periods of concurrent polarity relationships occurring in less than one cycle.

131. (New) The method as defined in claim 130, wherein said first waveform is at least partially offset from said second waveform by a controlled length of time.

132. (New) The method as defined in claim 130, wherein each of said waveforms has its own power source.

133. (New) The method as defined in claim 130, wherein at least one of said waveforms is created by a number of current pulses occurring at a frequency of at least 18 kHz with a magnitude of each pulse controlled by a wave shaper.

134. (New) The method as defined in claim 130, wherein said first and second waveforms are at least partially synchronized.

135. (New) The method as defined in claim 130, wherein said first and second waveforms are at least partially out of phase from one another.

136. (New) The method as defined in claim 130, wherein said first and second waveform are substantially the same.